Biasing Arrangement for a Pawl of a Reversible Ratchet-Type Wrench

Background of the Invention

1. Field of the Invention

The present invention relates to a biasing arrangement for a pawl of a reversible ratchet-type wrench to provide reliable ratcheting. The present invention also relates to an improved head structure for a ratchet-type wrench to lower the manufacture cost.

2. Description of the Related Art

U.S. Patent No. 2,957,377 issued to Hare on Oct. 25, 1960 discloses a reversible ratchet type wrench comprising a body 10 having a handle 11 and a head 12. A cap 39 and an annular wall 44 are provided to upper side and lower side of the head 12, respectively. Yet, this increases the assembly time and the manufacture cost and adversely affects the appearance. A shifting lever 35 is retained in place by a spring 33 that is located in a cylindrical opening 34. Nevertheless, formation of the cylindrical opening 34 that extends upward at an incline ~~inclined upward~~ is relatively difficult. In addition, formation of the cavity 16 having converging straight sides 17, 18 which diverge in the direction of the periphery of rotatable member 14 requires expensive and accurate computer-numeric-control (CNC), which further results in an increase in the cost together with a low production rate. This is why such a reversible ratchet type wrench is hardly seen in the market.

Figs. 10 and 11 illustrate another conventional ratchet type wrench comprising a handle 12' and a head 11'. The head 11' is machined to form four consecutive compartments for receiving the drive member 20', the pawl 30' and the shifting lever 40', wherein three of the compartments can be formed by cutting, yet the remaining one must be machined by CNC. Further, the resultant head structure is relatively weak and thus has a poor torque-bearing capacity. In addition, the movement of the pawl 30' for changing ratcheting direction is found unreliable, as it is achieved via transmission of the hook end 442' of a spring 44' attached to the shifting lever 40'.

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Summary of the Invention

In accordance with a first aspect of the invention, a reversible ratchet-type wrench comprises:

a handle;

a head extended from the handle and including a hole, a web being defined between the handle and the head, a cavity being defined in the web and communicated with the hole, the web further including a compartment having a first end communicated with the cavity and a second end communicated with outside, thereby leaving a bridge in the web;

a drive member rotatably mounted in the hole of the head, the drive member including a plurality of teeth formed on an outer periphery thereof;

a pawl mounted in the cavity and including a first side with a plurality of ratchet teeth for releasably engaging with the teeth of the drive member;

a switch member including a turn-piece for manual operation and an actuating plate extended from the turn-piece and rotatably received in the second end of the compartment of the web, the switch member being switchable between two positions for changing ratcheting direction of the drive member; and

a biasing means mounted in the cavity and between the pawl and the actuating plate for biasing the ratchet teeth of the pawl to engage with the teeth of the drive member.

An inner periphery defining the hole of the head includes a first annular groove. The outer periphery of the drive member includes a second annular groove. A C-clip is received in the first annular groove and the second annular groove, thereby rotatably retaining the drive member in the head.

The biasing means includes an elastic element and a peg. The pawl further includes a second side with a recess. The peg has a first end movably received in the recess of the pawl and a second end. The elastic element biases the second end of the peg for exerting a force to the peg toward the pawl, thereby urging the ratchet teeth of the pawl to engage with the teeth of the gear wheel.

In an embodiment of the invention, the actuating plate of the switch member includes a receptacle that faces the cavity. The elastic element includes a first end received in the receptacle and a second end outside the receptacle and configured to be attached to the actuating plate. The second end of the peg is received in the elastic element. The first end of the elastic element is configured to bias the second end of the peg toward the recess of the pawl.

In another embodiment of the invention, the actuating plate of the switch member includes a first receptacle that faces the cavity, the first receptacle having a first end wall. The second end of the peg is received in the first receptacle and includes a second receptacle with a second end wall. Two ends of the elastic element are attached between the first end wall and the second end wall.

The drive member may be a gear wheel including an inner periphery for driving a fastener. Alternatively, the drive member includes a drive column for releasably engaging with a socket. The head includes an end wall with an opening, and the drive member includes a stub rotatably received in the opening.

In accordance with a second aspect of the invention, a reversible ratchet-type wrench comprises:

a handle;

a head extended from the handle and including a hole, a web being defined between the handle and the head, a cavity being defined in the web and communicated with the hole, the web further including a compartment communicated with the cavity;

a drive member rotatably mounted in the hole of the head, the drive member including a plurality of teeth formed on an outer periphery thereof;

a pawl mounted in the cavity and including a first side with a plurality of ratchet teeth for releasably engaging with the teeth of the drive member, the pawl further including a second side with a recess;

a switch member including a turn-piece for manual operation and an actuating plate extended from the turn-piece and rotatably received in the compartment of the web, the switch member being switchable between two positions for changing ratcheting direction of the drive member; and

a biasing means mounted in the cavity and between the recess of the pawl and the actuating plate for biasing the ratchet teeth of the pawl to engage with the teeth of the drive member, the biasing means including an elastic element and a peg, the peg having a first end movably received in the recess of the pawl and a second end, the elastic element biasing the second end of the peg for exerting a force to the peg toward the pawl, thereby urging the ratchet teeth of the pawl to engage with the teeth of the gear wheel;

the actuating plate of the switch member including a receptacle that faces the cavity, the elastic element including a first end received in the receptacle and a second end outside the receptacle and configured to be attached to the actuating plate, the second end of the peg being received in the elastic element, the first end of the elastic element being configured to bias the second end of the peg toward the recess of the pawl.

In accordance with a third aspect of the invention, a reversible ratchet-type wrench comprises:

a handle;

a head extended from the handle and including a hole, a web being defined between the handle and the head, a cavity being defined in the web and communicated with the hole, the web further including a compartment communicated with the cavity;

a drive member rotatably mounted in the hole of the head, the drive member including a plurality of teeth formed on an outer periphery thereof;

a pawl mounted in the cavity and including a first side with a plurality of ratchet teeth for releasably engaging with the teeth of the drive member, the pawl further including a second side with a recess;

a switch member including a turn-piece for manual operation and an actuating plate extended from the turn-piece and rotatably received in the compartment of the web, the switch member being switchable between two positions for changing ratcheting direction of the drive member; and

a biasing means mounted in the cavity and between the recess of the pawl and the actuating plate for biasing the ratchet teeth of the pawl to engage with the teeth of the drive member, the biasing means including an elastic element and a peg, the peg having a first end movably received in the recess of the pawl and a second end, the elastic element biasing the second end of the peg for exerting a force to the peg toward the pawl, thereby urging the ratchet teeth of the pawl to engage with the teeth of the gear wheel;

the actuating plate of the switch member including a first receptacle that faces the cavity, the first receptacle having a first end wall, the second end of the peg being received in the first receptacle and including a second receptacle with a second end wall, the elastic element having two ends that are attached between the first end wall and the second end wall.

In accordance with a fourth aspect of the invention, a reversible ratchet-type wrench comprises:

a handle;

a head extended from the handle and including a hole, a web being defined between the handle and the head, a cavity being defined in the web and communicated with the hole, the web further including a compartment communicated with the cavity;

a drive member rotatably mounted in the hole of the head, the drive member including a plurality of teeth formed on an outer periphery thereof;

a pawl mounted in the cavity and including a first side with a plurality of ratchet teeth for releasably engaging with the teeth of the drive member, the pawl further including a second side with a recess;

a switch member rotatably received in the compartment of the web, the switch member being switchable between two positions for changing ratcheting direction of the drive member; and

a biasing means mounted in the cavity and having a first end slidably received in the recess of the pawl and a second end attached to the switch member for biasing the ratchet teeth of the pawl to engage with the teeth of the drive member.

Other objects, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is an exploded perspective view of an end portion of a first embodiment of a ratchet-type wrench in accordance with the present invention.

Fig. 2 is a sectional view of the end portion of the first embodiment of the ratchet-type wrench in accordance with the present invention.

Fig. 3 is a top view, partly sectioned, of the end portion of the first embodiment of the ratchet-type wrench in accordance with the present invention, wherein the wrench is in a status allowing counterclockwise ratcheting.

Fig. 4 is a view similar to Fig. 3, wherein the wrench is in a status allowing free rotation in both directions.

Fig. 5 is a view similar to Fig. 3, wherein the wrench is in a status allowing clockwise ratcheting.

Fig. 6 is a perspective view of the end portion of the first embodiment of the ratchet-type wrench in accordance with the present invention.

Fig. 7 is a sectional view illustrating a second embodiment of the ratchet-type wrench in accordance with the present invention.

Fig. 8 is a top view of an end portion of a third embodiment of the ratchet-type wrench in accordance with the present invention.

Fig. 9 is a sectional view illustrating a fourth embodiment of the ratchet-type wrench in accordance with the present invention.

Fig. 10 is an exploded perspective view of a conventional ratchet type wrench.

Fig. 11 is a sectional view of a head portion of the conventional ratchet type wrench in Fig. 10.

Detailed Description of the Preferred Embodiments

Referring to Figs. 1 through 9 and initially to Figs. 1, 2, 3, and 6, a ratchet-type wrench 10 in accordance with the present invention generally includes a handle 12 and a head 11 having a hole 13. An inner periphery 132 defining the hole 13 of the head 11 includes an annular groove 131 in a lower portion thereof. A web 17 is defined between the head 11 and the handle 12. A cavity 14 is defined in the web 17. Also defined in the web 17 is a compartment 15 that is substantially L-shape and includes an inner end communicated with the cavity 14 and an outer end communicated with outside, thereby leaving a bridge 16 on the web 17. The outer end of the compartment 15 is preferably circular. The bridge 16 increases the strength of the head 11 and the handle 12, thereby providing a higher torque-bearing capacity.

A drive member (in the form of a gear wheel 20 in this embodiment) is mounted in the head 11 and includes an inner periphery 24 for driving a fastener (not shown) and an outer periphery 25. The outer periphery 25 includes a recessed upper end portion 22, a lower end portion 23, and a middle portion with a plurality of recessed teeth 21. The lower end portion 23 includes an annular groove 231. A C-clip 30 is received in the annular groove 231 of the lower end portion 23 and the annular groove 131 of the head ~~13~~ 11, thereby rotatably retaining the gear wheel 20 in the head 11 of the wrench 10, best shown in Fig. 2.

A pawl 40 is mounted in cavity 14 in the web 17 and includes ratchet teeth 41 on a side thereof for engaging with teeth 21 of the gear wheel 20. The other side of the pawl 40 further includes a recess 42 having two ends 421 and 422, which will be described later.

Still referring to Figs. 1 through 3, a switch member 50 is rotatably mounted to the second end of the compartment 15. In this embodiment, the switch member 50 includes a turn-piece 51 outside the compartment 15 for manual operation and an actuating plate 52 extended from the turn-piece 51 and having a receptacle 521 that faces the cavity 14. A biasing means 60 is mounted in the receptacle 521 and includes an elastic element 62 and a peg 61. In this embodiment, as illustrated in Fig. 2, the elastic element 62 includes a first end 621 configured to bias an end 612 of the peg 61. A second end 622 of the elastic element 62 is configured to have a larger diameter so as to bear against and thus be attached to the actuating plate 52 in an area surrounding an opening section (not labeled) of the receptacle 521, as shown in Fig. 3.

In assembly, the switch member 50 is mounted in the compartment 15 and the biasing means 60 is mounted into the receptacle 521 of the switch member 50 via the cavity 14 with the elastic element 62 surrounding a part of the peg 61. The end 612 of the peg 61 bears against the first end 621 of the elastic element 62. The pawl 40 is mounted into the cavity 14 with the other end ~~612~~ 611 of the peg 61 extended into the recess 42 of the pawl 40. The C-clip 30 is placed into the hole ~~132~~ 13 and the gear wheel 20 is then mounted in the hole ~~132~~ 13 with the C-clip 30 received in the annular grooves 131 and 231, thereby completing the assembly. Thus, the assembly procedure is simple and can be accomplished quickly by a C-clip 30 without the aid of any screw or cover.

The ratchet-type wrench in Fig. 3 is in a status allowing counterclockwise ratcheting (free rotation in clockwise direction), in which the other end 611 of the peg 61 bears against an end 422 of the recess 42 of the pawl 40, and an end 44 of the pawl 40 bears against a wall portion defining the cavity 14. When a change in the ratcheting direction is required, the user may switch the turn-piece 51 and thus cause the biasing means 60 to move. Fig. 4 shows a transition position for the ratchet-type wrench that allows free rotation in both directions. As illustrated in Fig. 4, the elastic element 62 is stretched during rotational movement of the turn-piece. When the turn-piece 51 reaches its predetermined position shown in Fig. 5, the other end 611 of the peg 61 bears against the other end 421 of the recess 42 of the pawl 40, and the

other end 43 of the pawl 40 bears against another wall portion defining the cavity 14. Thus, the ratchet-type wrench is in a status allowing clockwise ratcheting and free rotation in the counterclockwise direction.

Fig. 7 illustrates a second embodiment in accordance with the present invention, wherein the gear wheel 20 is replaced by a drive member 70 having a drive column 73 with an engaging means 80 for releasably engaging with a socket (not shown). The drive member 70 includes an outer periphery having a plurality of teeth 71 for engaging with the ~~pawl~~ ratchet teeth 41. An annular groove 731 is defined in a lower portion of the outer periphery of the drive member 70 for engaging with the C-clip 30, which is identical to that disclosed above. In addition, the drive member 70 includes a stub 72 on a top thereof, and the upper portion of the head 11 is modified to include an end wall 133 with an opening 134 for rotatably receiving the stub 72 of the drive member 70, thereby providing stable rotational movement for the drive member 70.

Fig. 8 illustrates a third embodiment in accordance with the present invention. It is noted that the biasing means (now designated by 90) in this embodiment includes a pin ~~92 that is~~ 91 having a receptacle 911 for receiving an end of the elastic element 92. Thus, the elastic element 92 is attached between an end wall (not labeled) defining the receptacle 911 of the pin ~~92~~ 91 and an end wall (not labeled) defining the receptacle 521 of the switch member 50.

Fig. 9 illustrates a fourth embodiment in accordance with the present invention. It is noted that the biasing means 90 in the fourth embodiment is identical to that of the third embodiment, and the drive member 70 in the fourth embodiment is identical to that of the second embodiment.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.